Supporting information for publication.

Diverse reactivity trends of Ni surface in Au@Ni core-shell nanoparticle probed by Near Ambient Pressure (NAP) XPS

A.B. Vysakh[a,b], Ruchi Jain[a,b], C.S. Gopinath[a,b,c], C. P. Vinod[a,b,c]*

[a]Catalysis Division, CSIR-National Chemical Laboratory,
Dr. Homi Bhabha Road, Pune, INDIA.
Fax: +91-20-25902633;
Tel: +91-20-25902086;
E-mail: cp.vinod@ncl.res.in
[b]Academy of Scientific and Innovative Research (AcSIR),
Anusandhan Bhawan, 2 Rafi Marg,
New Delhi, Delhi 110001
[c]Center of Excellence on Surface Science,
CSIR-National Chemical Laboratory,
Dr. Homi Bhabha Road, Pune, INDIA

Uv-Vis spectra, HR-TEM images, Magnetic measurements, XRD analysis and XPS spectra of Au@Ni core-shell nanoparticles are available in this section.

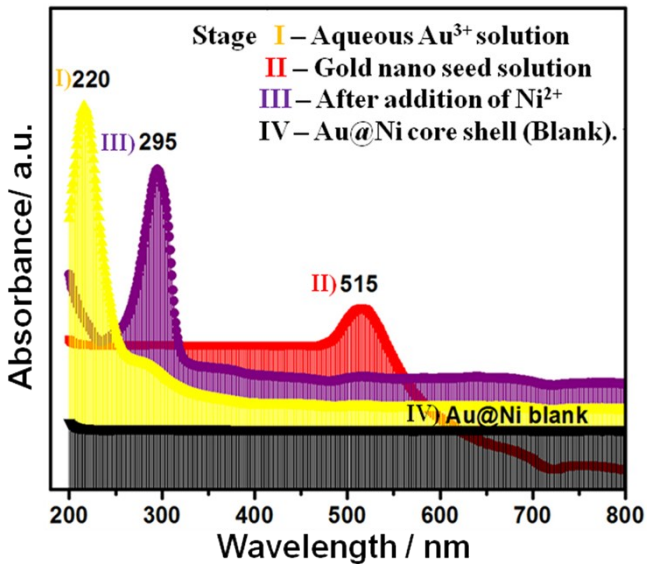

Figure S1: UV-Vis spectra recorded at each stage of synthesis of Au@Ni core-shell nanoparticles.

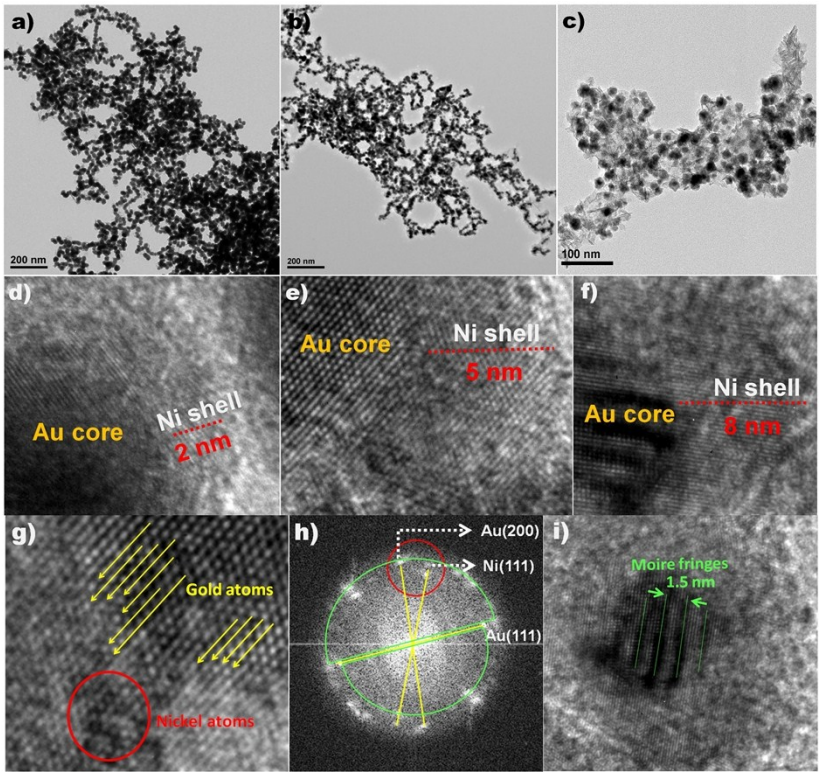

Figure S2: TEM images of Au@Ni core-shell nanoparticles. (a-c) corresponds to the large area TEM images and (d-f) HR-TEM images showing the nickel shell thicknesses of (a,d) $Au_{80}@Ni_{20}$, (b,e) $Au_{65}@Ni_{35}$ and (c,f) $Au_{50}@Ni_{50}$ core-shell nanoparticles. (g) shows an atomic resolution image of the interface of Au and Ni in Au@Ni core-shell system. (h) is the FFT (fast-Fourier-transform) pattern obtained from a single core-shell nanoparticle indicating the d-spacing values of Au, Ni and (i) demonstrates the moire fringes in Au@Ni core-shell system.

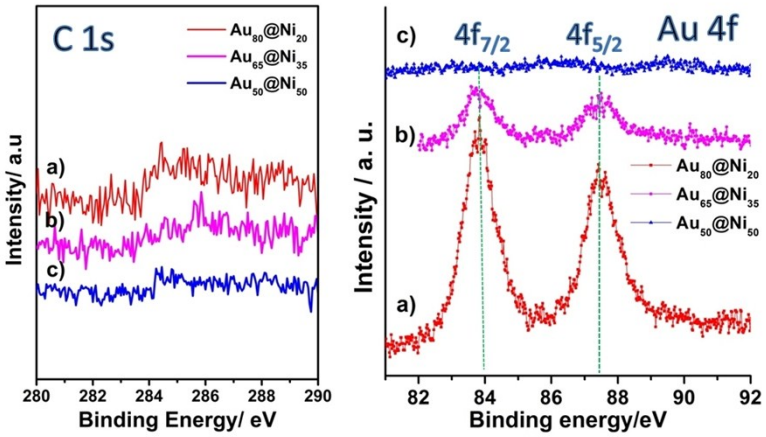

Figure S3: C 1s and Au 4f spectra of the as synthesized (a) $Au_{80}@Ni_{20}$ (b) $Au_{65}@Ni_{35}$ and (c) $Au_{50}@Ni_{50}$ core-shell nanoparticles at UHV-RT conditions.

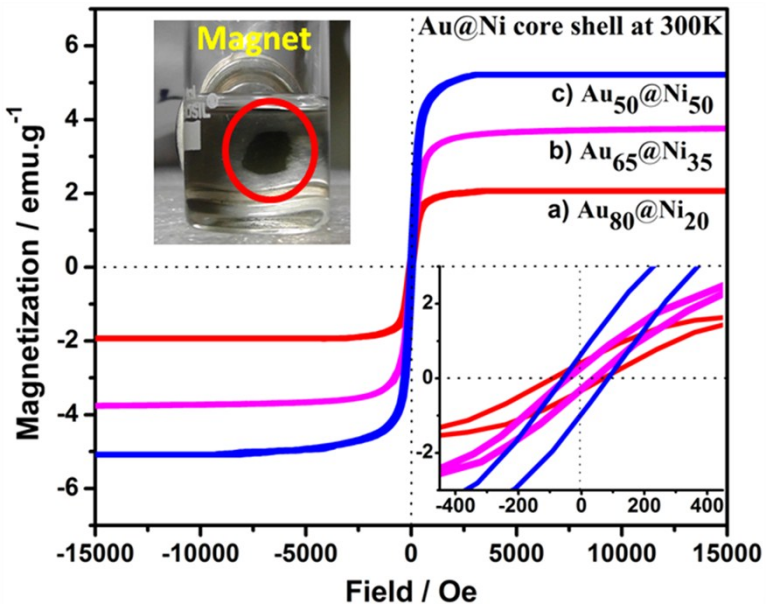

Figure S4: Hysteresis loops of (a) $Au_{80}@Ni_{20}$ (b) $Au_{65}@Ni_{35}$ and (c) $Au_{50}@Ni_{50}$ nanoparticles obtained at room temperature. Inset (down) shows the hysteresis width near to the zero magnetic field. Digital photograph shows the ferromagnetic character of Au@Ni core shell nanoparticles.

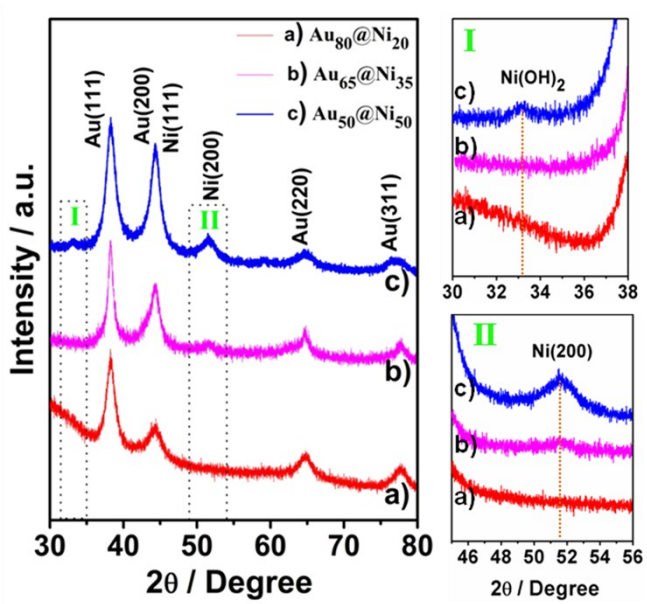

Figure S5: XRD patterns of core shell (a) $Au_{80}@Ni_{20}$, (b) $Au_{65}@Ni_{35}$ and (c) $Au_{50}@Ni_{50}$ nanoparticles. (I & II) are the zoomed images of the area marked in the dotted boxes and the dotted lines corresponds to $Ni(OH)_2$ and metallic Ni features respectively.

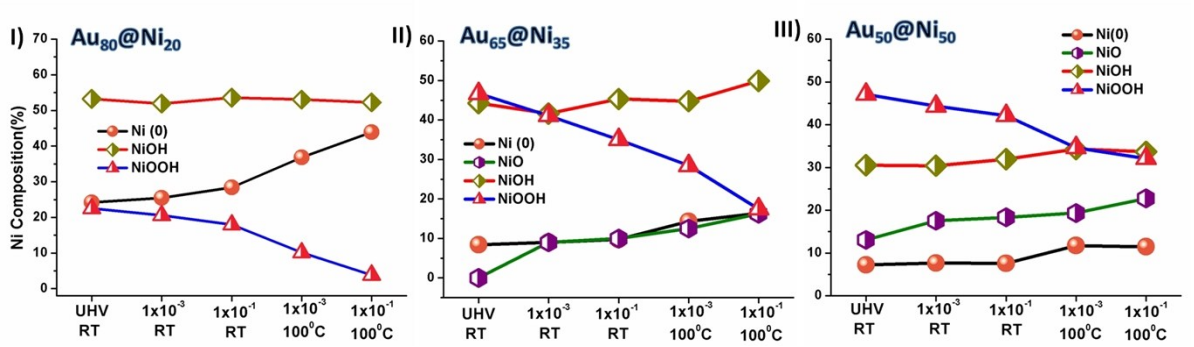

Figure S6: Changes in percentage composition of various nickel species present in $Au_{80}@Ni_{20}$, $Au_{65}@Ni_{35}$ and $Au_{50}@Ni_{50}$ at various pressure and temperature conditions.

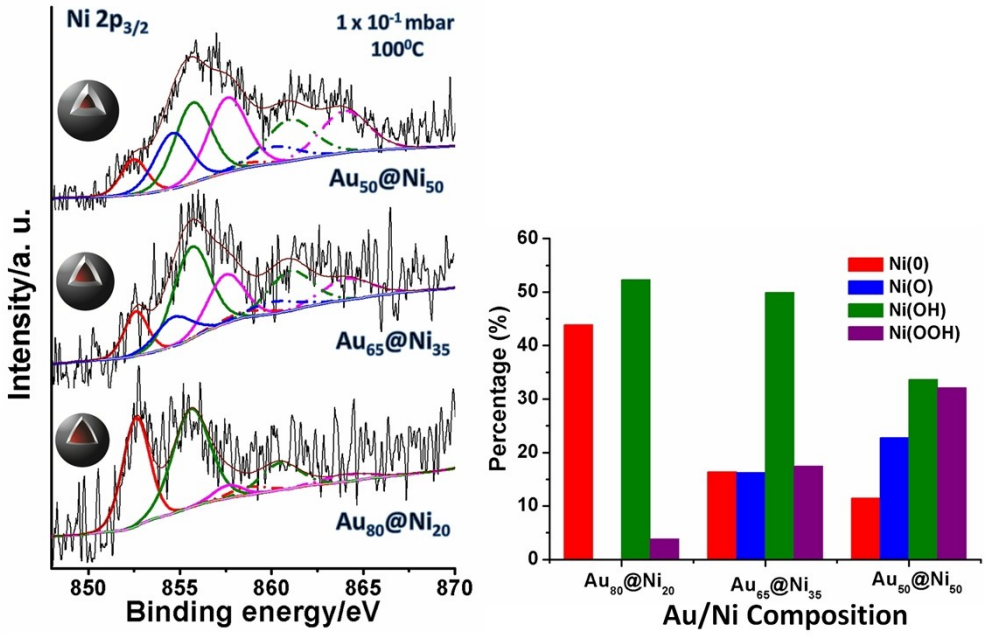

Figure S7: Ni $2p_{3/2}$ spectra and its deconvolution obtained for $Au_{80}@Ni_{20}$, $Au_{65}@Ni_{35}$ and $Au_{50}@Ni_{50}$ core-shell nanoparticles at 0.1mbar oxygen pressure and 100^0C. Figure b)

Corresponding percentage composition of various nickel species present in $Au_{80}@Ni_{20}$, $Au_{65}@Ni_{35}$ and $Au_{50}@Ni_{50}$ nanoparticles at 0.1mbar oxygen pressure and 100^0C.

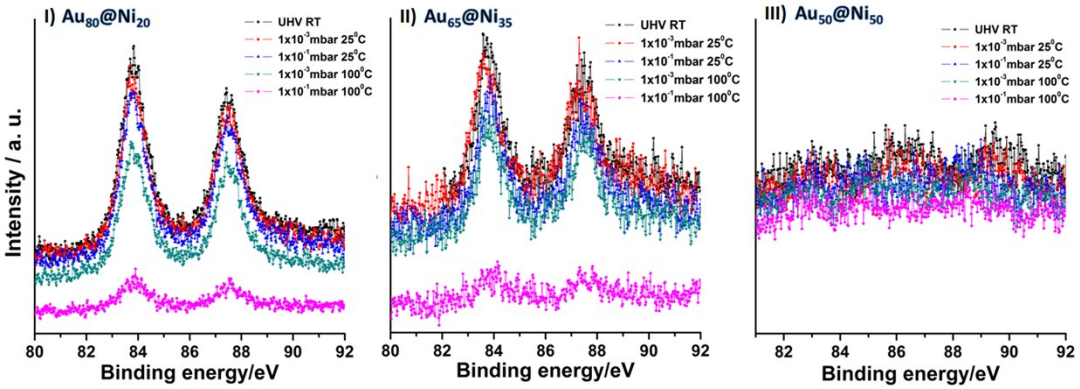

Figure S8: Au 4f spectra obtained for (I) $Au_{80}@Ni_{20}$, (II) $Au_{65}@Ni_{35}$ and (III) $Au_{50}@Ni_{50}$ under oxygen atmosphere at various pressure and temperature conditions.